an exact fifth with each other; and, on counting the number of indentations contained in a given length of each series, it appeared that for 30 of the lower sound there were 45 of the higher, which numbers are in the exact proportion (2 : 3), which connects the lengths of two equally tense wires, giving that interval. Galileo, who had felt a tremor pass from the chisel to his hand at each experiment, inferred that what really determined a musical interval was the ratio of the numbers of vibrations performed in equal times by its constituent notes, and that that ratio was inversely as that of the lengths of the wires producing them. In order to bring out the crucial nature of his experiment, he goes on to remark, with extreme acuteness, that there was, prior to it, no reason for regarding the relations known to connect musical intervals with the *lengths* of wires as in any exclusive sense *representing* such intervals. With equal propriety might the ratio of the *tensions* under which two wires of equal lengths emitted sounds forming an interval be taken as its representative. In this case we should obtain the inverse square root of the ratio resulting from the former mode of comparison. Thus Galileo's experiment alone supplied decisive ground for concluding that the relations of *length* between similarly circumstanced wires, likewise governed those of *period* between corresponding aërial vibrations.

Prof. Tyndall, in referring to the above experiment, has described it as performed "by passing a knife over the edge of a piastre" ("Sound," 2nd ed., p. 51). This is an obvious mistake caused by incorrect translation. Galileo was scraping "una piastra d'ottone," *i.e.*, not "a piastre," but "a plate of brass." An excellent numismatist assures me that the *material* mentioned is alone decisive of the point, the piastre in Galileo's time being invariably made of *silver*. SEDLEY TAYLOR

THE HOOSAC TUNNEL

THE following facts respecting the Hoosac tunnel, in which the borings from east and west communicated on Nov. 28, may prove of interest. The mountain penetrated is part of the chain of mountains that skirts, at a distance of two or three hundred miles inland, the Atlantic coast of the United States; of which the Blue Ridge in Virginia, the Alleghanies in Pennsylvania, the Catskills and Adirondacks in New York, the Green Mountains in Vermont, and the White Mountains in New Hampshire, are prominent examples. Hoosac Mountain has two summits, the eastern being 2,210, and the western 2,508 ft. above tide-water.

The enterprise has been the subject of various undertakings by different contractors, and the greater part of the earlier work during the years from 1848 to 1863, in length but one-twelfth of the whole distance, was on a smaller scale than the subsequent plan adopted, and had to be much enlarged and strengthened. The present contract requires a clear width of bore of 24 ft. and a height of 20 ft.; the total length of the tunnel is 25,031 ft. A central shaft pierces it from above, at a distance of 12,837 ft. from the eastern, and 12,194 ft. from the western portal. The shaft has a depth of 1,038 ft., and is of elliptical form, its major axis is 27 ft. being coincident with the line of the tunnel; its minor axis is 15 ft. The grade of the tunnel slopes up to the shaft from both ends, with a rise of $26\frac{4}{10}$ per mile. The shaft is not placed at the lowest point between the two summits of the mountains, as the exigencies of the work at the western extremity, and the presence of a stream of water at the point of lowest depression, made a site half a mile nearer the western portal preferable. The tunnel is 767 ft. above tide-water at its extremities. The temperature within averages 58° F.

The total excavation is about 1,000,000 tons of rock, requiring somewhat over 1,450,000 days' work. The boring was principally through mica schist, similar to that of the surface. The miners found it lying on the edge of the foliations and disposed to hang together after the blast. They compared the operation of working in it to pulling boards endwise from a pile of lumber. Rock of this character was found continuous until a point was reached within about 5,000 feet west of the central shaft. At that point the proportion of mica was diminished and the rock began to lose its foliated structure, becoming more homogeneous or granitic. In fact it might be characterised in general terms as granite with the ingredients differently proportioned at different localities, in some places feldspar, in some mica, and in others quartz predominating. This rock was harder to penetrate with the drills, but broke out more satisfactorily with the blast than the mica schist.

The chief trouble was occasioned by what received the name of "demoralised rock." This was rock saturated with water, which, exposed to air, disintegrated into mere mud, rendering the support of masonry absolutely necessary. The tunnel will not probably be ready for railway traffic before next July, as there is yet much work to be done, the total cost at that date, it is estimated, will not fall short of 12,500,000 dols.

NOTES

ON Monday last the French Academy of Sciences named Mr. J. Norman Lockyer, F.R.S., one of its Correspondents, to fill the place rendered vacant in the Astronomical Section by the death of Encke. We believe that the following is a complete list of the English scientific members of the French Institute at the present time:—Foreign Members—Prof. Owen, Sir C. Wheatstone. Correspondents: Geometry—Prof. Sylvester. Mechanics—Sir Wm. Fairbairn. Astronomy—Sir G. Airy, Mr. Hind, Prof. Adams, Prof. Cayley, Sir Thomas MacLear, Mr. Lockyer. Geography and Navigation—Admiral Richards, Dr. Livingstone. Physics—Dr. Joule. Chemistry—Dr. Frankland, Dr. Williamson. Mineralogy—Sir C. Lyell, Prof. W. H. Miller. Botany—Dr. Hooker. Anatomy and Zoology—Dr. Carpenter.

AT the meeting of the Paris Academy of Sciences, which took place on December 22, the places of Correspondents in the Physical Section, vacant by the death of M. Hansteen, and the election of Sir C. Wheatstone to a foreign associateship, were filled up by the election of MM. Angström and Billet.

HER MAJESTY'S Commissioners have resolved to commence, in connection with the series of international exhibitions, permanent collections which shall illustrate the ethnology and geography of the different portions of the British dominions, and ultimately form a great national museum of the empire upon which the sun never sets. They will be arranged for the present in the galleries of the Royal Albert Hall. Many portions of the empire are inhabited by aboriginal races, most of which are undergoing rapid changes, and some of which are disappearing altogether. These races are fast losing their primitive characteristics and distinguishing traits. The collections would embrace life-size and other figures representing the aboriginal inhabitants in their ordinary and gala costumes, models of their dwellings, samples of their domestic utensils, idols, weapons of war, boats and canoes, agricultural, musical, and manufacturing instruments and implements, samples of their industries, and in general all objects tending to show their present ethnological position and state of civilisation. It is proposed to receive for the Exhibition of 1874 any suitable collections, which will be grouped and classified hereafter in their strict ethnological and geographical relations. As, however, there is at present great public interest in the various tribes inhabiting the West Coast o

Africa, including the Ashantees, with whom this country is at war, all objects relating to the Ashantees, Fantees, Dahomeys, Houssas, and the neighbouring tribes are especially desired. The Indian Empire, the Eastern Archipelago, and the islands of the southern hemisphere, are also able to afford abundant and valuable materials for the proposed museum, of which it is believed that the nucleus can be formed at once from materials in private collections. Her Majesty's Commissioners confidently appeal to the civil, military, and naval officers of the British service throughout the Queen's dominions to assist them in these collections. Her Majesty's Commissioners have secured the services of eminent gentlemen to advise them from time to time in giving effect to these intentions. It is requested that offers of gifts and loans of objects should be made known at once to the Secretary of Her Majesty's Commissioners, Upper Kensington Gore, London, S.W.

IN reference to recent communications on the rate of stalagmitic deposit, Mr. Thomas K. Callard writes to say that he thinks the probability is that the rate of deposit in Kent's Cavern was not uniform, "for, when the thick forest (the habitat of the animals whose bones are found in the cave) left an accumulation of decayed vegetation on the soil, we had the natural laboratory where the rain would find the carbonic acid, to act as a solvent upon the calcareous earth, and as this acidulous liquid percolated through the soil and dripped into the cave, we have the origin of the stalagmite; but as, by the axe of man, the forest decreased, in that proportion the chemicals lessened, and as a consequence the deposit diminished. Besides the diminution of the solvent, every year that the operation was going on the material that composed the stalagmite must have been decreasing in the superjacent soil, so that the bicarbonate of lime which now takes two centuries to cover one-eighth of an inch, might have been, in days gone by, the work of much shorter time." Mr. W. Bruce Clarke writes that he visited, about ten years ago, a cavern near Buxton, commonly known as "Poole's Hole," and observed some stalagmite, probably ^{8} in. in the back, had become deposited upon the gas-pipes, which were used to light the cave, and had been laid down six months before. At this rate, granting that the deposit had been six months in acquiring a thickness of ⅛ in., 1 in. would be deposited in four years, a rate of deposit even more rapid than that (viz. ¾ in. in fifteen years) mentioned by Mr. Curry in the number of NATURE for December 18. It must be remembered, however, that though at one particular spot in "Poole's Hole," 1 in. of stalagmite might be deposited in four years, the same rate would probably not be maintained all over the cave.

THE Sub-Wealden Exploration has proved far more expensive than was at first anticipated, and additional funds will be required to complete the desired depth of 1,000 ft. A third sum of 1,000*l.* has now been promised, and this will form the basis for future operations. This amount includes 200 *l.* from the Duke of Devonshire, 100*l.* from Lord Leconfield, 50*l.* from the Earl of Ashburnham, 50*l.* from the Royal Society, and 25*l.* from the Duke of Norfolk. These sums will be collected as the work proceeds, and additional contributions are solicited. The importance attributed to the enterprise by Professor Phillips in the Geological Section, during the last meeting of the British Association at Bradford, is an additional proof, if any were needed, of the expediency of completing the investigation.

PROF. OWEN, who is suffering from a troublesome bronchial affection, is spending the winter in Egypt.

MR. J. ALLEN, of Clifton College, has been elected to the Natural Science Exhibition at St. John's College, Cambridge (50*l* per annum tenable for three years). The examiners reported that the merits of Mr. Lodge were very nearly equal to those of the successful candidate. There were ten candidates.

THE Caspian Sea is extremely rich in various species of fish, many of these occurring in prodigious numbers. Indeed, according to Alexander Schultz, the yield is very much greater than that of the Great Bank of Newfoundland. Thus in one single district 15,000 sturgeon are frequently taken in a day, and when the fishing is interrupted for twenty-four hours the waters become almost choked by the abundance of fish, which are so numerous as to press each other out upon the shore. The total yield of the Caspian Sea for one year in fish and fish products has been estimated at 13,000,000 *pouds* (about 469,430,000 pounds avoirdupois), worth about 12,000,000 dols. There are several varieties of sturgeon among the fish taken, including the sterlet, as well as the carp and other cyprinoids, the salmon, the *Coregonus* (similar to the white-fish of the American lakes), several kinds of herring, &c. A peculiar phenomenon observed especially among the sturgeon is that of a kind of winter sleep. At the approach of cold weather they seek the deep portion of the rivers, and remain there in a state of torpor, during which they secrete a viscid matter which forms a coating over the entire body, called by the fishermen a *pelisse.* During this period they appear to eat nothing, their stomachs always being found entirely empty.

MR. DALL, of whose movements as a surveyor and explorer in the Aleutian Islands in behalf of the Coast Survey we have advised our readers from time to time, returned on the 8th Nov. to San Francisco, where he will spend the winter in preparing his report to Prof. Peirce. Part of his labours had special reference to the selection of a suitable locality for an intermediate land station for the proposed Pacific cable between the United States and Japan. Mr. Dall expects to return in the spring to finish his explorations on the islands.

AMONG recent discoveries of valuable minerals in Australia is that of iron in the form of magnetic iron, and brown hematite at Wallerawang, Victoria, in close proximity to limestone, fire-clay, coal, and a railway station.

THE Italian Scientific Commission, appointed to examine, from an anthropological point of view, the remains of the Italian poet Petrarch, and to publish the result of its observations at the centenary of the great poet, proceeded, we learn from *La Nature,* in the beginning of December to open the urn of red granite, amid a large gathering of people. The bones, instead of being contained in a coffin of wood or metal, were spread upon a simple plank, and were of an amber colour, moist, and partly mouldered. The cranium, of medium size, was intact, the frontal bone much developed. The jaws still contained many teeth, among which were a number of molars and incisors very well preserved. The orbits were very large. Nearly all the vertebræ and ribs were found. The bones of the pelvis were in good condition, as also the scapula, the humerus, and the other bones of the arms; the apophyses of the femurs were very prominent. There was discovered also a quantity of small bones which probably composed the hands and the feet. The vestments were reduced to a dark powder. From the size and length of the bones, we may conclude that Petrarch was a man of middle height and robust constitution.

AT one of the last sittings of the French Academy of Medicine, says *La Nature,* M. Devergie read a remarkable report on the prize of the Marquis d'Ourches, a prize of 25,000 francs, to be given to the man who should discover an infallible method of recognising certain death. The method must be so simple as to be at the command of the most illiterate and rude. Besides this prize, the testator instituted another of 5,000 francs for the discovery of a scientific method of arriving at the same result. The value of the prize of 25,000 francs has tempted people of all classes and all conditions; thus the Academy has received 102 memoirs, not counting those which arrived after the expiration of the time announced for their reception. Of these 102 memoirs, only 32 were judged worthy of serious examination. But no one has gained the famous prize of 25,000 francs, which therefore reverts to the testator's family. As to the prize of 5,000 francs, it will probably be divided among various competitors who have presented interesting memoirs.

At the Annual Meeting of the Institution of Civil Engineers, held on December 23, it was stated that on the 30th November last, the number of members and associates was 1,994. On the subject of finance, it was stated that during the last fourteen years the savings had amounted to something like 2,000*l.* per annum, on the average. The receipts are now nearly 9,000*l.* per annum, while the ordinary expenditure was only 6,000*l.* per annum. What with trust funds, investments, and cash balance, the Institution has 30,233*l.* 8*s.* 6*d.* at its disposal. The library numbers 10,443 volumes.

We would draw the attention of our London readers to the advertisement in this week's Nature with regard to the Junior Philosophical Society, meeting at 6a, Victoria Street, S.W. We believe we have had occasion to speak of it before, as one whose object and method of work are commendable.

The January number of Petermann's *Geographisches Mittheilungen*, contains a contribution by Dr. Nachtigal giving valuable details concerning the various Pagan tributaries to the kingdom of Baghirmi. Dr. Meyer gives some statistics of the inhabitants of the Philippine Islands, whose number he estimates at 7,451,352. In the same number is a communication from Dr. Miklucho-Maclay, dated Batavia, October 25, 1873, in which he maintains that the Papuas and Negritos belong to the same race, notwithstanding that the former are dolichocephalic, and the latter brachycephalic.

The principal article in Guido Cora's excellent Italian Geographical Journal *Cosmos*, is on "Recent Expeditions to New Guinea."

The "Second Report of the Committee on Boulders appointed by the Royal Society of Edinburgh," contains much interesting information which will no doubt be ultimately of service to geologists.

We have received the first number of *The Argonaut* (Hodder and Stoughton), a journal started by "a number of young fellows who are just entering on the bolder thoughts or the more active duties of manhood," for the purpose of discussing questions in which all earnest young men take an interest. It professes to be devoted to no party either in religion, politics, or philosophy. It is edited by Mr. George Gladstone, F.C.S., and this first number contains an Introduction by Dr. Gladstone, F.R.S. The contents are varied and mostly interesting.

The Opening Address to the Geological Association, by the president, Mr. Henry Woodward, F.R.S., has been printed as a supplemental number of the Proceedings. The Address is a survey of what has been done in geology during the past twelve months.

"The Glaciation of the Northern Part of the Lake District," is the title of a paper by Mr. J. Clifton Ward, reprinted from the *Quarterly Journal of the Geological Society.*

The *Mémorial Diplomatique* states that the Italian Consul at the Piræus has informed his Government that M. Théodore Tubini, banker, at Athens, has obtained a concession for cutting a canal through the Isthmus of Corinth. The principal clauses of the concession are that the canal shall have a *minimum* depth of 8½ metres (27 ft.), and a width of 12 metres (39 ft.) at the bottom. Half-way through the canal is to be a dock of 30,000 square metres in extent, and of sufficient depth to receive the largest vessels. The canal is to be completed in six years. The concession is for 99 years, and a deposit of 12,000*l.* is to be paid immediately after the Greek Parliament has approved the concession. The estimated cost of the undertaking is 800,000*l.*

The principal papers in No. 39 of the *Journal of the Scottish Meteorological Society*, are "The Report of the Committee appointed to investigate the Relation of the Herring Fishery to Meteorology," an abstract of which has been given in our report of the Society's meeting, and a valuable paper by the Rev. W. Clement Ley, "On the Mean Inclination of Winds towards the Lower Isobarics." The Journal contains, as usual, the admirably compiled quarterly Meteorological returns from the Society's numerous stations.

We have received a reprint from the "Proceedings of the Geologists' Association" of Mr. Henry Hick's paper on the "Classification of the Cambrian and Silurian Rocks.

Part III. of vol. xxii. of the "Transactions of the North of England Institute of Mining and Mechanical Engineers" consists entirely of an elaborate and valuable paper on the geology of the Redesdale ironstone district, by Mr. G. A. Lebour, of the Geological Survey. It is accompanied by two useful maps of the district.

An aerolite, *Iron* says, weighing about twelve pounds fell in the vicinity of Marysville, Cal., on the 24th of August, which was so hot that it could not be handled for some time. It came crashing through the tree tops with a bright flash, and was found buried eight feet in the ground.

The additions to the Zoological Society's Gardens during the past week include an Asiatic Wild Ass (*Equus onager*) from S.W. Asia, presented by Capt. H. L. Nutt; an Anubis Baboon (*Cynocephalus anubis*) and a Patas Monkey (*Cercopithecus ruber*) from W. Africa, presented by Mr. A. E. Oakes; a Bonnet Monkey (*Macacus radiatus*) from India, presented by Mr. F. E. Bradley; a Hybrid Duck (between ♂ *Aix sponsa* and ♀ *A. galericulata*), presented by Mr. J. C. Parr; a Yarrell's Curassow (*Crax yarrelli*) from S.E. Brazil, and a Coypu (*Myopotamus coypus*) from S. America, purchased.

SCIENCE IN KÖNIGSBERG

We have before us the *Schriften der Königlichen Physikalisch-Okonomischen Gesellschaft zu Königsberg*, for 1871-72, in which is to be found a considerable amount of useful scientific observations, both of local and general interest. Dr. Berendt, who, along with some coadjutors, has been engaged in preparing a full geological map of Prussia, and in other geognostic researches, describes a specimen of immature amber brought from the sea-bottom on the Samland coast. Under a wrinked and brittle crust, the resinous substance was soft, transparent, and highly elastic. From some similarity of physical properties (not complete, however), Dr. Berendt inclines to identify it with a fossil resin found by Bergemann in brown coal of Lattorf, and described under the name of kranzit. The sp. gr. of the new substance is 0·934; it is insoluble in alkalies, spirit of wine, oil of turpentine, soluble in sulphuric acid; it begins to melt at 300°; in air it burns with a luminous sooty flame, giving a peculiar smell; it is free of sulphur, but contains a little nitrogen, like amber and some kinds of asphalte.

The same author has given much attention to the formation of amber in Prussia, and in an earlier number of the *Schriften* (1869, first part) will be found a very full investigation, by him, of the subject. In one of the present numbers he gives an account of preparations lately made for subterranean mining of the substance in Samland. Hitherto this method has not been adopted, and on two accounts chiefly; the nature of the superincumbent strata (which are generally sand and clay), and the high value of amber, which sufficiently repaid the other method. The Government, however, has lent some aid, and in July 1872 boring was commenced at the southern base of Carlsberg, where, at a depth of about forty-four metres, blue earth was found containing amber in abundance. This is about 5·7 m.,